編號： 126

國立成功大學 106 學年度碩士班招生考試試題

系　　所：工程科學系

考試科目：電子電路

考試日期：0214，節次：1

※ 考生請注意：本試題可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。***請依題號順序作答。***

1. Mark each of the following statements True (T) or False (F). (Need NOT give reasons.) (20 pt.)

(a) The insulator, SiO_2, makes the gate current of the MOSFET zero.

(b) The common-drain amplifier can be used to amplify the source and load with a large and small resistance, respectively.

(c) Integrating large capacitors and resistors is easy for the modern IC process.

(d) Active devices are usually used as loads for discrete-circuit amplifiers.

(e) Accurate current transfer ratio and small output resistance are properties of an ideal current source.

(f) We use short-circuit time constant for the upper 3dB frequency analysis of the amplifier.

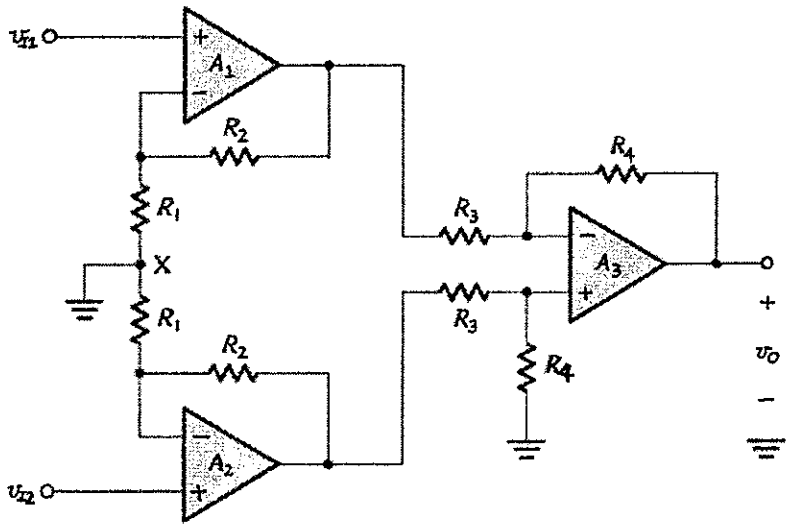
(g) NMOS transistors conduct currents owing to major electrons and holes.

(h) Miller's effect typically has a bad influence on the bandwidth of amplifiers.

(i) AC coupling is typically applied in IC amplifiers.

(j) The saturation mode of a BJT is used to amplify the small signals.

2. In the following amplifier, R_1=0.5 kΩ, R_2=0.5 MΩ, R_3=R_4=20 kΩ. (a) Find $A_{Id} \equiv \frac{v_O}{v_{Id}}$, where $v_{Id} = v_{I2} - v_{I1}$. (10 pt.) (b) If $v_{I1} = 0.1\sin(2\pi t) + 0.05\cos(2\pi t)$ and $v_{I2} = 0.03\sin(2\pi t) - 0.05\cos(2\pi t)$, find the output voltage. (10 pt.).



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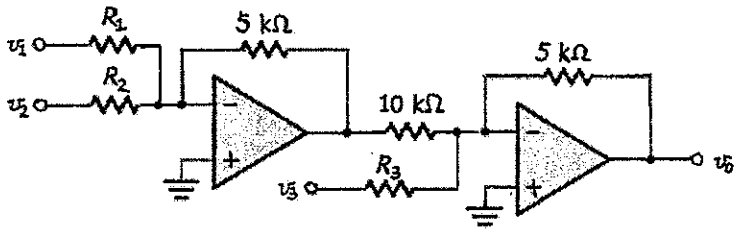
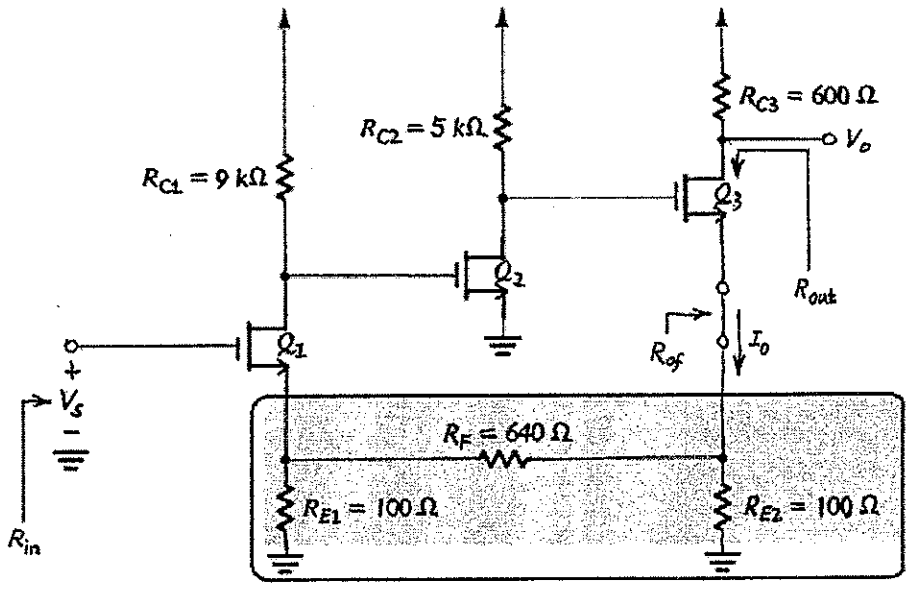
3. Design the following amplifier such that $v_O = 2v_1 + 3v_2 - 4v_3$. What are R_1, R_2, and R_3? (20 pt.).



4. For the following feedback circuit, assume that for all transistors , g_m= 10mA/V , r_o=∞. Determine: (a) The closed-loop gain $A_f = {}^{I_o}/_{V_s}$, and ${}^{V_o}/_{V_s}$. (10 pt.) (b) The input resistance R_{in}. (5 pt.) (c) Assume that r_o of Q_3 is 50 kΩ, calculate the output resistance R_{out}. (5 pt.) [*Hint* : Recall that for MOSFET with a resistance R_s in its source, the resistance looking into the drain is $(r_o + R_s + g_m r_o R_s)$.]



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5. In the following MOS differential amplifier, assume $g_{m1}=g_{m2}=g_{m3}=g_{m4}=40\text{mA/V}$ and $r_{o1}=r_{o2}=r_{o3}=r_{o4}=25\ \text{k}\Omega$. Use the differential half-circuit to derive the differential gain A_d. (20 pt.)